

NOVEL CLEATED ANTI-CREEP FLOOR MATS

Cross Reference to Related Applications

This application is a divisional of co-pending application 09/405,883, filed on September 24, 1999. This parent application is herein entirely incorporated by reference.

Field of the Invention

The present invention relates to specific methods of producing cleated rubber-backed floor mats (such as dust control or rubber mats) through the utilization of the combination of a perforated coated woven fabric article and a cushioned platen liner between the article and the metal platen of an in-line dust control mat manufacturing machine. Such a procedure permits a more efficient manner of producing cleated anti-creeper dust control mats than previously followed. In particular, the fabric article is in the form of a conveyor belt and is preferably constructed from Teflon®-coated woven fiberglass which will not adhere to the tacky rubber component of the target mat and can withstand the extremely high vulcanization temperatures and pressures required during the production of a dust control mat. The cushioned platen liner, which is preferably comprised of or coated with silicon, is utilized as a separator between the metal platen of the manufacturing machine, as well as cushion for the molten rubber as it is pressed through the conveyor belt perforations during vulcanization. Such a cushioned liner material substantially eliminates any problems due to the force of the metal platen against the molten rubber as it passes through the article perforations. The produced mat as well as the

woven fabric article/cushioned platen liner combination are also encompassed within this invention.

Background of the Prior Art

All U.S. patents cited herein are hereby fully incorporated by reference.

Floor mats have long been utilized to facilitate the cleaning of the bottoms of people's shoes, particularly in areas of high pedestrian traffic such as doorways. Moisture, dirt, and debris from out of doors easily adhere to such footwear, particularly in inclement weather and particularly in areas of grass or mud or the like. Such unwanted and potentially floor staining or dirtying articles need to be removed from a person's footwear prior to entry indoors. As will be appreciated, such outdoor mats by their nature must undergo frequent repeated washings and dryings so as to remove the dirt and debris deposited thereon during use. These mats are generally rented from service entities which retrieve the soiled mats from the user and provide clean replacement mats on a frequent basis. The soiled mats are thereafter cleaned and dried in an industrial laundering process (such as within rotary washing and drying machines, for example) and then sent to another user in replacement of newly soiled mats. Furthermore, it is generally necessary from a health standpoint to produce floor coverings on which persons may stand for appreciable amounts of time which will provide comfort to such persons to substantially lower the potential for fatigue of such persons by reducing the stress on feet and leg joints through cushioning.

Typical carpeted dust control mats comprise solid and/or foam rubber backing sheets which must be cleated in some manner to prevent slippage of the mat from its designated area. Such cleats are formed during a vulcanization step and have required a time-consuming procedure of placing the green (unvulcanized) rubber sheet on a molded, perforated silicone pad which is itself placed by hand on the conveyor belt of a dust control manufacturing apparatus. The finished mat is then removed after vulcanization from the non-stick silicon pad. The resultant mat product possesses cleats formed through the melting and forcing of part of the rubber backing through the pad perforations during vulcanization. Such cleats provide anti-slip or anti-creep characteristics to the finished mat when placed upon a surface to be protected. Various types, shapes, and arrangements of cleats have been utilized in the past for such anti-creep benefits with dust control mats. Examples include U.S. Patents 4,741,065 to Parkins, 5,170,526 to Murray, and 5,227,214 to Kerr et al.

As noted above, previous methods of providing such cleat features to rubber-backed mats are generally produced through the utilization of a perforated silicon pad which is placed by hand on a conveyor belt on in in-line vulcanization apparatus. A rubber article is then placed on top of silicon pad, and optionally a fabric pile (such as a carpet) is then placed, again by hand, on top the rubber article. The conveyar belt then transports the entire composite to a vulcanization chamber wherein it is pressed at a pressure of from about 25 to about 40 psi at a temperature of from about 300 to about 400°F for anywhere between about 30 seconds and 20 minutes. After vulcanization, the conveyor belt transports the finished composite (floor mat plus silicon pad) out of the chamber. The floor mat is then removed from the pad and allowed to cool and the pad is

moved, by hand, back to a location on the conveyor belt, prior to the chamber, in order for another rubber article to be placed thereon. Such a procedure is labor-intensive and inefficient. However, until now, there have been no disclosures of proper methods to reduce the time and labor required to effectively and efficiently produce rubber-backed cleated floor mats. There have been developments in conveyor belts, particularly those covered with Teflon® coatings, for utilization in other rubber molding processes. However, there has been no discussion or suggestion regarding the problems associated with cleat-forming perforated conveyor belts in the past. In light of the above, it will be appreciated that there is a need for a process and apparatus to efficiently produce cleats within the rubber backing of an anti-creep floor mat. The present invention thus represents a useful advancement over prior practice.

Object of the Invention

In view of the foregoing, it is a general object of the present invention to provide an in-line method for the production of cleats in a rubber or rubber-backed floor mat. Furthermore, it is an object of this invention to provide a novel conveyor belt system for an in-line floor mat manufacturing apparatus. Additionally, an object of this invention is to provide a cleated anti-creep floor mat which is more easily and efficiently produced than standard cleated floor mats. Still another object of this invention is to provide an anti-creep floor mat which exhibits not only cleats to provide anti-slip characteristics, but also intermittent patterned areas within the rubber on the underside of the rubber floor mat component which mirrors the woven structure of the perforated fabric article.

Accordingly, this invention encompasses a method of producing a cleated anti-creep floor mat comprising a rubber mat component with a mat producing apparatus comprising the steps of:

(a) providing a perforated woven fabric article, which is coated or comprised of a material which will not adhere to said rubber mat component after a vulcanization step, wherein said perforated woven fabric article is optionally separated from the metal platen of said apparatus by a cushioned platen liner;

(b) placing said rubber mat component on top of said perforated woven fabric article of step "a" and optionally placing thereon a fabric pile;

(c) transporting the rubber mat component/perforated woven fabric article composite to a vulcanization chamber; and

(d) vulcanizing said rubber mat component as it remains on top of the perforated woven fabric article, thereby forming cleats through the perforations of said perforated woven fabric article;

wherein said woven fabric article and said optional platen liner are comprised of or coated with materials which can withstand the temperatures and pressures associated with vulcanization. Also, this invention concerns a floor mat manufacturing apparatus having a metal platen wherein said apparatus further comprises a perforated conveyor belt positioned on top of a cushioned platen liner which is positioned on top of said metal platen. Additionally, this invention encompasses floor mat article comprising at least a rubber sheet component wherein said rubber comprises a plurality of cleats formed integrally on the surface and at least a portion

of the surface of said rubber sheet also comprises a weave pattern of molded rubber.

The term "perforated" or "perforations" is intended to encompass any configuration of holes within the woven fabric article structure through which molten rubber may be forced during vulcanization. Thus, any shape hole, any orientation of holes, and any depth of such holes is encompassed within such a term. Preferably, the holes (perforations) are circular in shape ultimately to produce cylindrically shaped cleats in the target mat article. Also, the diameter of such perforations are preferably from about 1/64 inch to about 1/4 inch; more preferably from about 1/32 inch to about 1/8 inch; and most preferably from about 3/32 to about 1/16 inch.

Preferably, the perforated woven fabric article of the instant invention is present in the form of a conveyor belt which thereby permits an in-line mat production procedure. In such a form, the platen liner must be utilized under the conveyor belt in order to reduce off-quality cleat production, as discussed below. However, if desired, the woven fabric article may also be a separate article which is cut from a web of fabric which can be placed by hand on a cushioned platen liner and/or on a standard conveyor belt within a mat manufacturing apparatus. After vulcanization, the finished mat can easily be removed from the fabric article and the fabric article can then be transported to a pre-vulcanization location for placement of another rubber mat component thereon. The preferred conveyor belt of the instant invention must be constructed of material which not only can withstand continuous and/or repeated movement around a rotating drum and through a standard in-line floor mat manufacturing apparatus; such materials (including the cut-out forms of such woven fabric articles) must also be able to withstand the high temperatures and pressures associated with rubber vulcanization. The core material of such

a belt or cut-out is thus preferably fiberglass although other materials, such as polyaramids, silicon, and the like, may also be utilized. The belt or cut-out should also be coated with a covering which can also withstand vulcanization temperatures and pressures and not appreciably adhere to molten rubber. Silicon may be utilized for this purpose as well; however, the preferred coating is polyfluoroethylene, also known as Teflon®, available from DuPont. The preferred conveyor belt (or cut-out fabric) is first produced by taking a woven (or non-woven) fiberglass fabric and coating it with a certain number of Teflon® layers. Perforations are then cut into the coated fabric to conform with the desired shape and orientation of ultimately formed cleats on the target floor mat article. Then, the cut fabric is coated with a few more layers of Teflon® in order to insure the potentially frayed fibers of the cut fiberglass will not interfere with the eventual removal of the target floor mat article from the belt surface. If such frayed fiber ends were not coated themselves, they could adhere to the mat and produce aesthetically displeasing results. The coated fabric, and thus the belt itself, may have a thickness of from about 1/64 inch to about 1/4 inch, depending on the desired size of the ultimately formed cleats. The thickness of the fabric (belt) dictates the length of the projected cleats from the rubber surface of the mat article since, upon melting during vulcanization, the rubber will become forced through the perforations of the belt a distance roughly the same as the belt thickness. Preferably, the cleat lengths are from about 1/64 to 1/4 inch, more preferably from about 1/32 inch to about 1/8 inch; most preferably about 3/32 inch.

The woven structure of such a fabric article is of vital importance to provide an extra anti-slip weave pattern feature to the finished floor mat product. Since woven fabrics exhibit differing textures at their surfaces due to the interlacing and crossovers of the individual yarns within the woven structure, the mirror image of such a woven structure will be transferred to the target rubber mat component during vulcanization as long as the fabric article remains in place under the rubber component during such a step. In the past, the production of cleats has been performed, as noted above, with silicon pads, and the like, which produced discrete cleats within the rubber mat component but generally did not include any anti-slip features between such produced cleat formations. Through the utilization of such a woven structure, the resultant fabric pattern can thus be transferred to the rubber surface which provides a roughened surface between produced cleats for improved anti-slip characteristics within the inventive floor mat.

Prior to incorporating the aforementioned preferred conveyor belt to a floor mat manufacturing apparatus (which generally comprises a metal platen over which the conveyor belt would be placed directly), a cushioned platen liner is placed over the metal platen. A platen liner may be placed beneath the cut-out woven fabric article as well; however, since the hand-placed fabric article would most likely be placed on a conveyor belt itself, or placed within a shelf-type vulcanization chamber, some degree of cushioning would already be provided which could render the utilization of such a platen liner unnecessary.

In general, it has been discovered that the platen liner should be present to avoid the creation of "flared" cleats in the final mat product. Such a problem is caused by both the lack of adhesion between the molten rubber and the Teflon®-coated fabric surface as well as the force

of the metal platen on the molten rubber forced through the fabric perforations. Without a cushioning platen liner, when the vulcanization chamber presses down on the mat article, the rubber, upon melting, is forced through the perforations into the metal platen. The force of the stationary metal platen then forces the rubber back toward the belt and rubber article; however, the molten rubber will seek the path of least resistance rather than returning through the perforation it came originally. Without the adhesion between the fabric and the rubber, the rubber will easily move between the fabric and the platen. In such an instance, upon exiting the vulcanization chamber, the mat article is not easily removed from the belt (since the rubber forms "hooks" on the underside of the belt). The resultant mat article thus exhibits aesthetically displeasing cleat formations which themselves possess suspect effectiveness as preventing slippage or creeping of the mat when placed on a protected surface. Hence, it was discovered that in order to provide such an efficient procedure of in-line cleat forming for floor mat articles, a cushioned platen liner was required to separate the fabric article (belt) from the metal platen and to provide cushioning of the rubber to prevent re-forcing back toward the belt itself during vulcanization. However, such a platen liner may not be required when a cut-out article is utilized to produce the desired cleats, most notably when the conveyor belt itself (which may be coated rubber, or other fabric, for example) within the mat manufacturing apparatus provides the necessary cushioning effect; but, other times there will be a need to utilize such a cushioned article to reduce the production of off-quality cleats.

When present, the platen liner preferably covers the entire area of the metal platen over which mat articles will be placed. Preferably, the platen liner will possess a modulus of from about about 40 to 70 on the Shore A Hardness Scale in order to provide the necessary cushioning effects for proper cleat formation. Preferably, the modulus is about 50 on the same scale. Furthermore, the platen liner must be able to withstand the high temperatures and pressures associated with rubber vulcanization. Thus, the liner must be constructed from material which possesses both characteristics. The preferred material is a rubber coated with silicon (available from Taconic, for example) which exhibits a Shore A Hardness of about 50. However, the liner may also be constructed from other heat-resistant materials which have been incorporated within flexible fabrics, rubber, and the like, and/or alternatively coated with a heat-resistant material, such as Teflon®, silicon, and the like. The thickness of such a liner is not of great importance, although, the thicker the better (for cushioning purposes). The utilization of too thick a liner will not seriously impact the effectiveness of the perforated conveyor belt in producing the desired cleats; however, as silicon liners are rather expensive, the thickness should be dictated primarily by cost versus available cushioning characteristics. As such, a thickness of from about 1/64 inch to about 1/2 inch is preferred; 1/64 to about 1/8 inch more preferred; and 1/64 inch to about 1/32 inch most preferred.

Brief Description of the Drawing

FIG. 1 is an aerial cross-sectional view of the composite of platen, platen liner, conveyor belt, and floor mat constructed to produce the inventive floor mat.

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While the invention will be described in connection with preferred embodiments and procedures, it is to be understood that the invention is in no way intended to be limited by such description. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the true spirit and scope of the invention as defined by the claims appended hereto.

Detailed Description of the Drawing

Turning now to the drawing wherein like reference numerals designate like components in the various views, in **FIG. 1** there is shown in profile the composite of different utilized components for production of the inventive floor mat article **10**. In the illustrated and preferred practice, a rubber mat backing sheet **12** is covered with, at least partially, and attached to (during vulcanization) a pile fabric **14** to form the desired floor mat **10**. Cleats **24** are formed in certain locations on the underside of the rubber mat backing sheet **12** through placement of the sheet **12** (with or without the pile fabric **14** on top, preferably with) over a woven fabric article, in this instance a conveyor belt **16**, which is formed from woven fiberglass and coated with Teflon® and which comprises cut-out holes **25** in certain locations on the belt **16** which correspond to the desired pattern of cleats **24** to be formed on the backing sheet **12**. The woven structure **27** of the conveyor belt **16** also transfers such a woven pattern **26** to the backing sheet **12** to provide increased slip resistance supplemental to the cleats **24**. In order to permit proper cleat formation on the backing sheet **12**, a cushioned platen liner **18** made from silicon rubber is present underneath the conveyor belt **16**. All of these layers of articles are placed upon the metal platen

20 of a mat manufacturing apparatus (not illustrated). The floor mat **10** has already been transferred by the belt **16** through a vulcanization chamber (not illustrated). Upon removal from the belt **16**, the floor mat possesses the desired cleats **24** and woven patterns **26** for anti-creep benefits upon use.

While specific embodiments of the invention have been shown and described, it will be understood, of course, that the invention is not limited thereto, since modifications may be made and other embodiments of the principles of this invention will occur to those skilled in the art to which this invention pertains. Therefore, it is contemplated by the appended claims to cover any such modifications and other embodiments as incorporate the features of this invention within the true spirit and scope of the following claims.